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ZOOLOGY.

How Young Flickers are Fed.—An interesting account of a brood of young flickers is given by Mr. William Brewster in *The Auk*, July, 1893. During three days observation, Mr. Brewster saw only the male parent, which, however, was very attentive to his charge. Alighting on the trunk of the stump containing the nest, the flicker would utter a peculiar call, a low anxious *woi* or *wó–ă*, addressed, apparently to the young, to which they would reply with a burst of clamor, and almost immediately their wide opened mouths would appear at the top of the burrow. Standing on the edge of the hole, the parent selected one, and bending forward and down drove his bill to its base into the gaping mouth which insantly closed tightly round it, when the head and bill of the parent were worked up and down with great rapidity for from one to one and a half seconds, the young meanwhile never losing its grasp. These up and down motions were rapid, regular, and not unlike those of a wood-pecker engaged in drumming. They also suggested the strokes of a piston. If interrupted during the pumping process, the flicker would often feed the same young twice or even thrice in succession, but this never happened when the first period of contact was of normal length.

Four young were generally fed at each visit, with a brief interval of rest between the operations. During this interval the parent would open and shut his bill, run out his tongue, and work the upper portion of his throat as if tasting and swallowing something. The inference was that this was for the purpose of regaining the particles of food which had failed to lodge in the throat of the young.

The time spent at the nest rarely exceeded half a minute, while the foraging expeditions occupied from twenty minutes to an hour. The flicker's return was so stealthy that the writer, although on the watch, frequently did not see him until he appeared at the nest. His bill was always closed up to the moment of contact and there was no evidence that he carried food in his mouth. In fact, it was clear that he *swallowed* all the food obtained and afterward supplied it to the young by a process of *regurgitation*. Of what the food consisted, the writer was unable to discover without killing one of the young, to which mode of settling the point he was extremely averse.

Forsyth Major and Rose on the Theory of Dental Evolution.—In the NATURALIST for June, 1893, Professor H. F. Osborn has stated the manner in which Kükenthal and Röse defend the theory that the complex dental crowns of the later Mammalia, are the result of the fusion of a number of primitive, distinct, simple reptilian teeth. Professor Osborn and myself have shown that the history of mammal dentition indicates the opposite process to have taken place ;. viz, the gradual accession of cusps to a simple primitive cusp, by a process of complication. The well known fact that the dental cusps become more numerous and display greater modifications with the passage of geological time, is opposed to the idea supported by the authors cited.

Dr. Röse has recently endeavored to explain[1] the origin of the dentition of the elephant. As is well known, the transverse crests are laminiform, and reach the number of twenty-three in the *Elephas indicus.* It is also well known that as we pass backward in time we find in the earliest known proboscidians, posterior molar teeth with only four, and even two transverse crests. This fact is one of many which distinctly negatives the fusion theory. Dr. Röse's explanation is truly extraordinary. He declares the complexity of the molar of *Elephas* to be due to a reversionary inheritance of a reptilian dentition, and fusion of the dental elements of the same. Thus the farther removed from the ancestral Reptilia we get, in time and in character, the stronger becomes the hereditary tendency ! This seems to be the *reductio ad absurdum* of the theory.

Dr. Forsyth Major makes an interesting contribution to the subject in a paper in the Proceedings of the London Zoological Society,[2] on the dentition of the Sciuridæ. He announces his disbelief in the tritubercular origin of the placental mammalian dentition, and supports the view that all the forms, including the tritubercular, are the descendents of a multitubercular type, as now found in the Multituberculata. He believes that the superior molars of the squirrels support his contention, as he thinks that he can trace them better from a multitubercular than from a tritubercular origin.

I have stated as is my belief, as long ago as 1883,[3] that the Glires were descended from the Tillodonta, and no reason has since appeared to invalidate this opinion. It was strikingly confirmed by the discovery that there were no Glires in the Puerco fauna, while Tillodonta are not rare. In the Tillodont dentition we have all the materials necessary for the evolution of the glirine dentition along the usual lines. Dr. Forsyth Major appears to have overlooked this aspect of the case, and it will be necessary to dispose of this theory before progress in any other direction can be made.—E. D. Cope.

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[1] Morphologischen Arbeiten von Schwalbe, Strassburg i. E., 1893, p. 173.

[2] Proceeds. Zoolog. Sci. London, 1893, p. 179.

[3] Extinct Rodentia of North America, AMERICAN NATURALIST, p. 380 ; Op. cit. 1885, p. 347 more definitely.

Effects of Temperature on the Coloring of Lepidoptera.—In Insect Life, Vol. III, p. 481, is given the following resumé of a series of temperature experiments conducted by Mr. Merrifield in pedigree moth-breeding, begun in previous years, on the pupa of *Selenia illustraria* and *Ennomos autumnaria.*

By careful and long continued experiments Mr. Merrifield has demonstrated the possibility of producing artificially from a single brood of a moth, subject to seasonal dimorphism, four distinct "temperature" varieties, viz.: summer markings with summer coloring, summer markings with an approach to spring coloring, spring markings with summer coloring, and spring markings with spring coloring. The conclusions reached as a result of this series of experiments are that the coloring and markings of the moth are affected by the temperature to which the pupa is exposed, the marking being chiefly produced by long continued exposure; that the coloring is affected chiefly during the stage before the coloring of the perfect insect begins to show; that a low temperature during this stage causes darkening, a high temperature producing the opposite effect, a difference between 80° and 57° being sufficient to produce the extreme variation in darkness caused by temperature; a further lowering of temperature having no further effect; that nearly the full effect in coloring may be produced by a range of temperature of from 76° or 80° to 65° in *autumnaria,* and from 73° to 60° in *illustraria;* that dryness or moisture during the entire pupal period has no appreciable effect on the coloring of the adult.

A general conclusion which the author ventures to suggest—provided we accept the theory of Professor Weismann, that existing forms of North American and European Lepidoptera have come down from a glacial period—is, that "icing" the pupa causes the insect to revert to its earlier form, and that experiments of the nature here recorded might be of material assistance in tracing the evolution of the markings on the wings of the most highly developed forms.

In a supplementary note Mr. Merrifield adds that it is possible to cause either the summer or winter form to take on the coloring of the other, and produce from moths from the summer pupa, specimens that resemble those from the winter pupa, but not *vice versa.*

The details of these experiments can be found in Part I, Trans. Ent. Soc., London, 1891, pp. 155–167.

Fish Acclimatization on the Pacific Coast.—The attention of fish culturists is called to the remarkable results of the experimental introduction of food fishes to the west coast of the United States. In 1871, the California Fish Commission deposited 12,000 young shad in the Sacramento River, and after that the United States Fish Commission carried on the work until 1886, during which time 609,000 young shad were placed in the Sacramento River, 600,000 in the Williamette, 300,000 in the Columbia, and 10,000 in the Snake River. Two or three years later a few mature examples were obtained in the Sacramento River, and, by degrees, marketable fish were obtained along the entire coast of the United States north of Monterey Bay. In 1887, they were abundant in some rivers, common in most of them, and occasional ones were found everywhere along this long coast line. In 1892, the catch was estimated at 660,000 pounds. A careful estimate places the total value of the shad catch on the Pacific coast to date at $145,000, representing over 3,000,000 pounds, while the aggregate outlay for all purposes connected with the introduction of the fry was less than $4,000.

The history of the striped bass, *Roccus lineatus*, is similar to that of the shad. In 1879, about 150 fish a few inches long were deposited at the mouth of the Sacramento River by an agent of the U. S. Fish Commission coöperating with the California Commission. In 1882, another plant of 300 fish was made in the same region. As a result of these two small plants, the species soon became distributed along the entire coast of California. The rapid growth of individuals, and the equally rapid distribution of the species indicate the special adaptability of the waters of the region to this fish.

In commercial importance the striped bass ranks high. Large quantities are taken for market in San Francisco Bay with seines and gill nets. The average weight is eight to ten pounds, but fish weighing forty pounds are not scarce. The aggregate yield to date is nearly 100,000 pounds with a value of $18,000. The cost of introduction was not more than a few hundred dollars. In both of these cases cited the investment of the people's money has proved most satisfactory. (Science, Aug., 1893).